(12) UK Patent Application (19) GB (11) 2 365 735 (13) A

(43) Date of A Publication 20.02.2002

(21) Application No 0115394.9

(22) Date of Filing 10.03.2000

Date Lodged 22.06.2001

(30) Priority Data
(31) 11065042 (32) 11.03.1999 (33) JP

(62) Divided from Application No 0005884.2 under Section 15(4) of the Patents Act 1977

(51) INT CL7
G06F 3/033

(52) UK CL (Edition T)
H4T TBAX

(56) Documents Cited
JP 070140963 A

(58) Field of Search
UK CL (Edition S) H4T TBAX
Online: WPI, EPODOC, JAPIO

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(54) Abstract Title
Controlling the scroll rate of a display based on the content of the data displayed

(57) A portable terminal comprises a receiver for receiving data, a display for displaying the data, wherein a first portion of the data is displayed on a first page and a second portion of data is displayed on a second page by scrolling the first page. A controller determines the page scrolling speed based on the content of the first portion of the data, wherein the scrolling of the first page to the second page is automatic and performed at the page scrolling speed.

FIG. 10

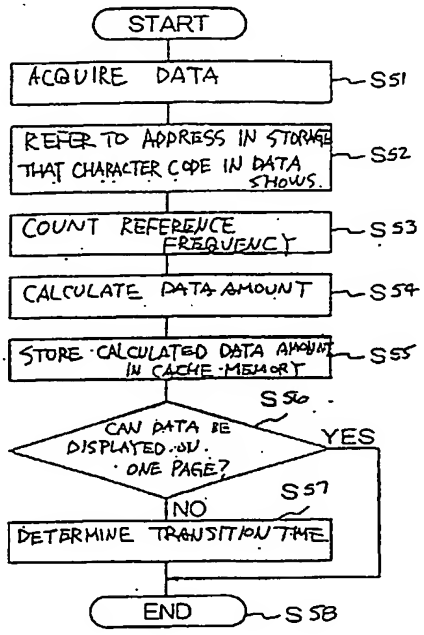

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FIG. 1

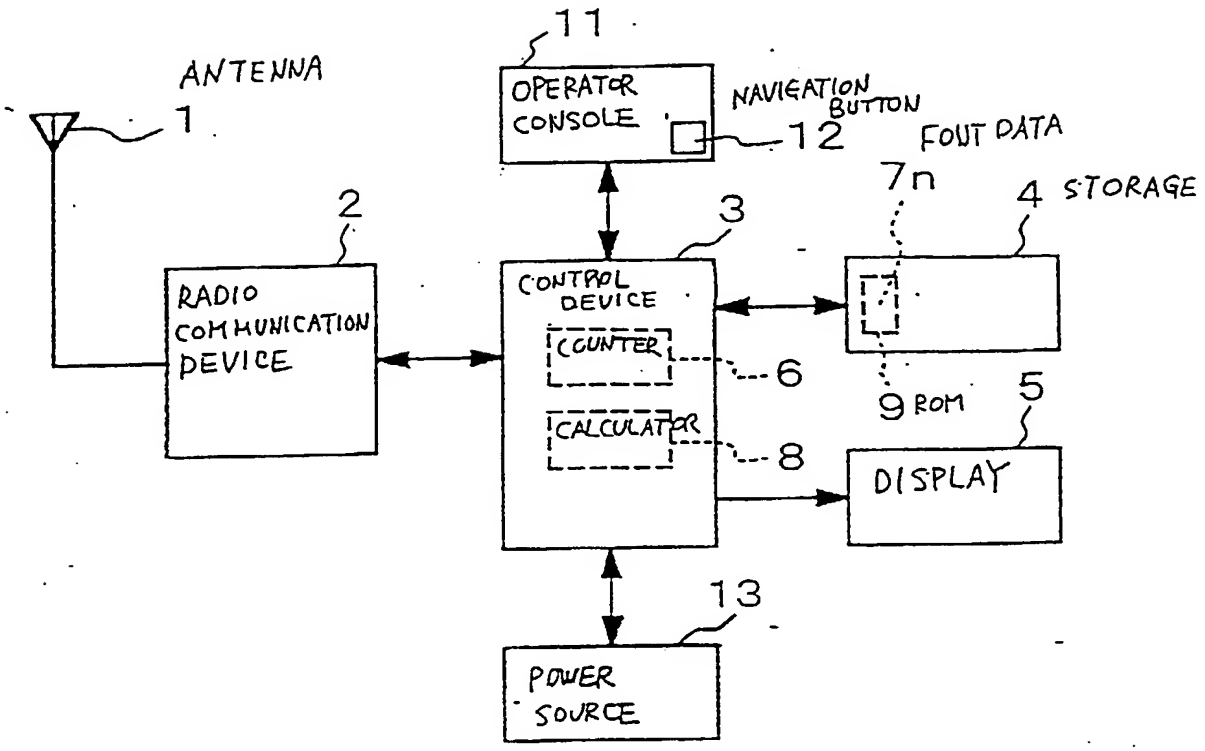


FIG. 2

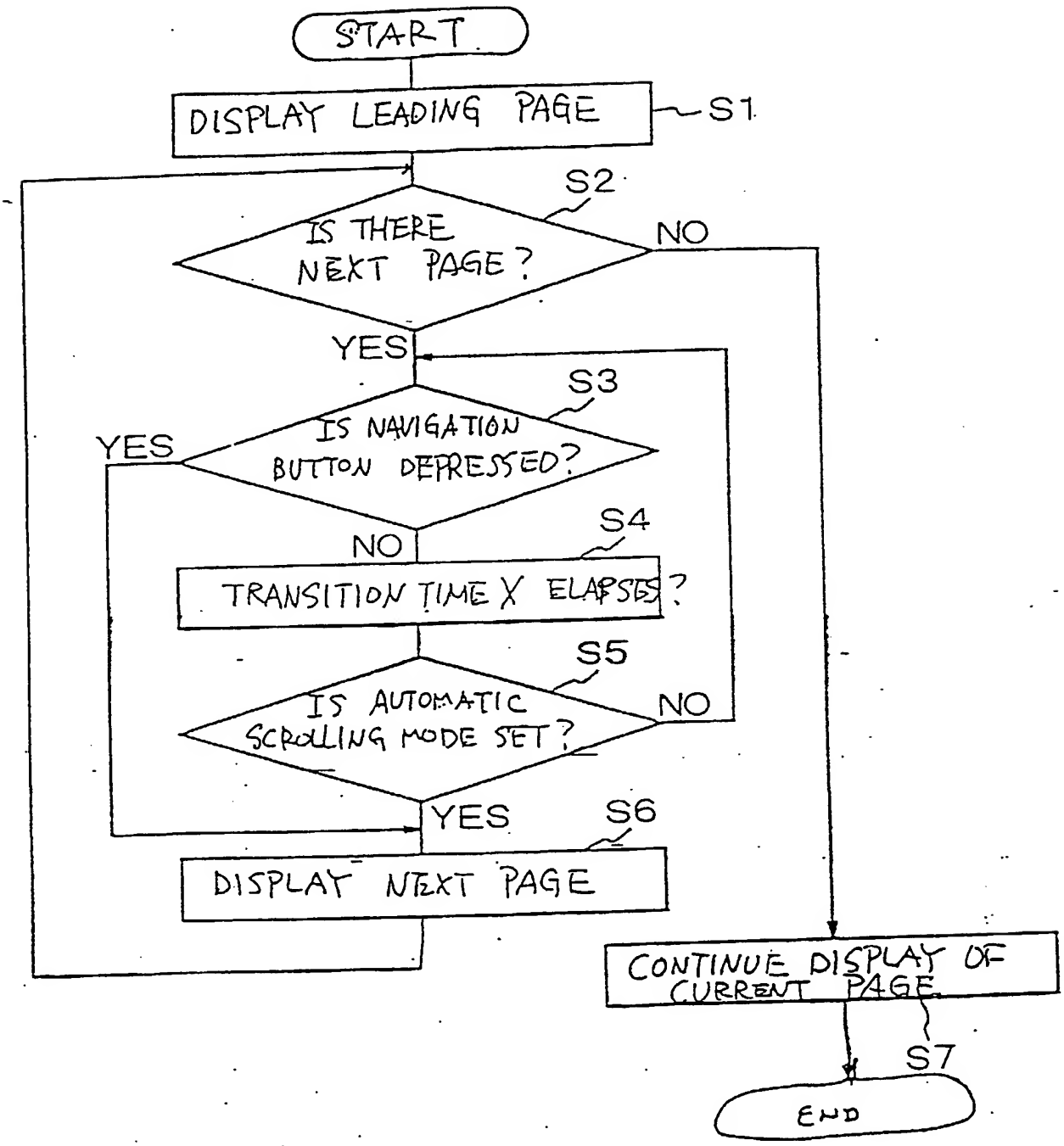


FIG.3

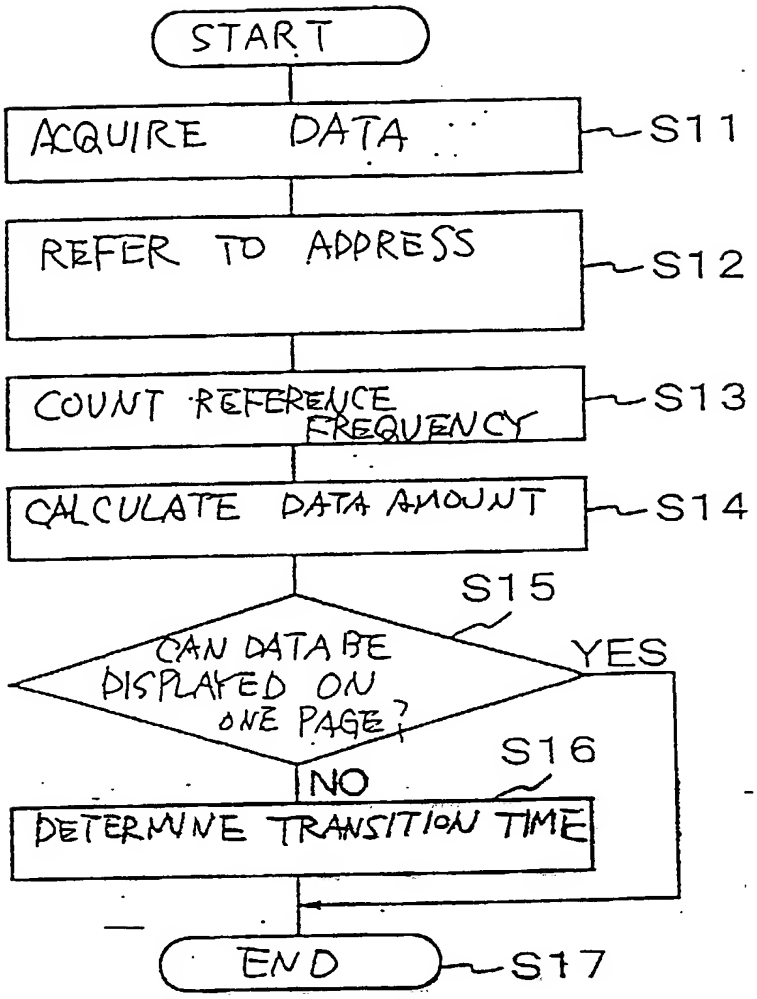


FIG. 4

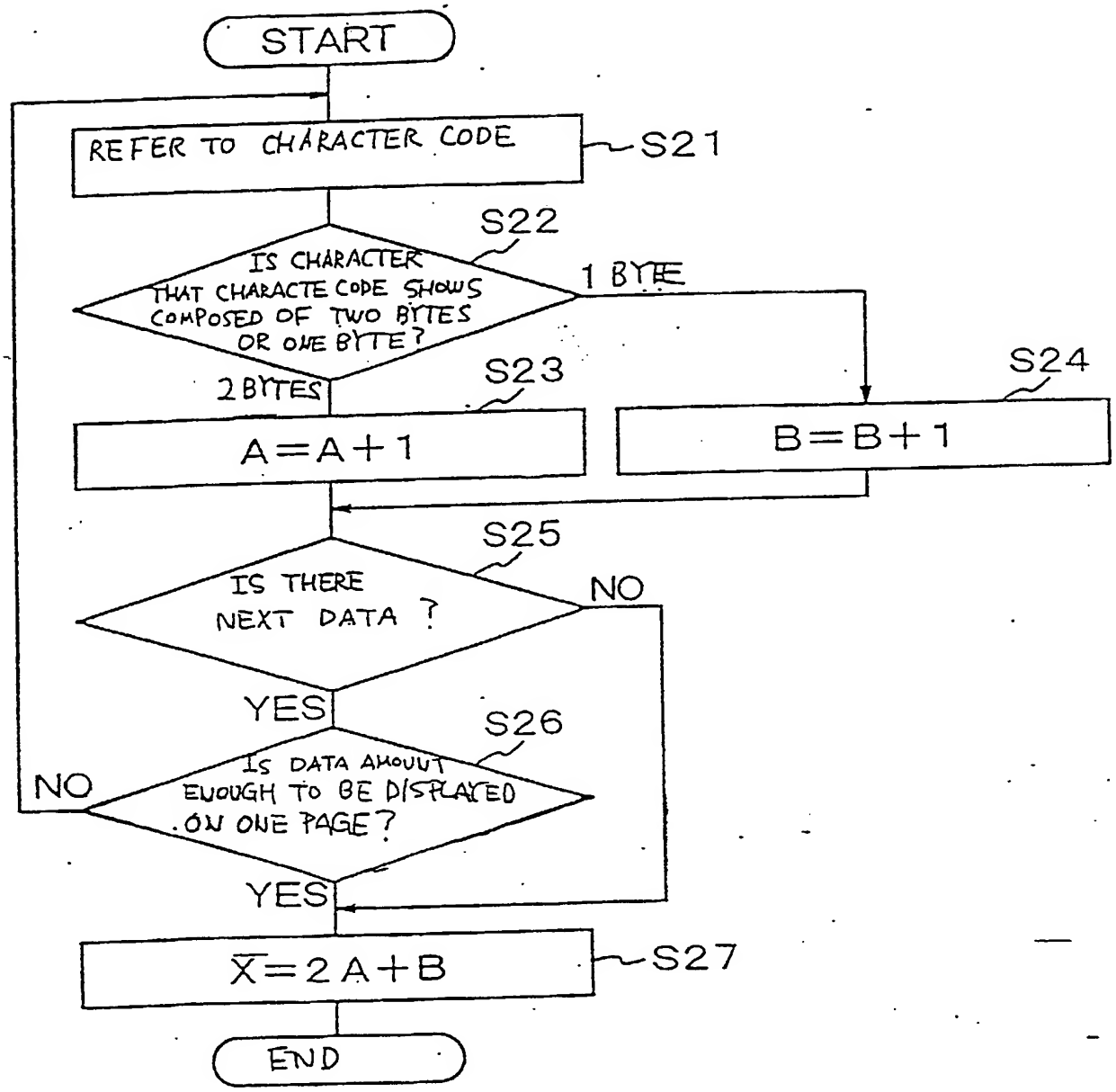


FIG. 5

FUNCTION	STATE	SET CONTENTS
SETTING AUTOMATIC SCROLLING MODE	OFF	
	ON	FAST (UNIT SCROLLING TIME: T1)
		NORMAL (UNIT SCROLLING TIME: T2)
		SLOW (UNIT SCROLLING TIME: T3)

FIG. 6A
LEADING PAGE

天気予報をお知らせします。午後3:00気象庁発表の予報では、関東地方は今夜

A=33
B=4
X=70

TRANSITION TIME =70T

FIG. 6B
SECOND PAGE

から明日にかけて大雨になるおそれがあります。

A=22
B=0
X=44

TRANSITION TIME =44T

FIG. 6C
THIRD PAGE

東京　雨
神奈川　雨のち曇
埼玉　雨
千葉　雨

A=16
B=0
X=32

TRANSITION TIME =32T

FIG. 6D
FINAL PAGE

以上で天気予報を終わります。

A=14
B=0
X=28

FIG. 7

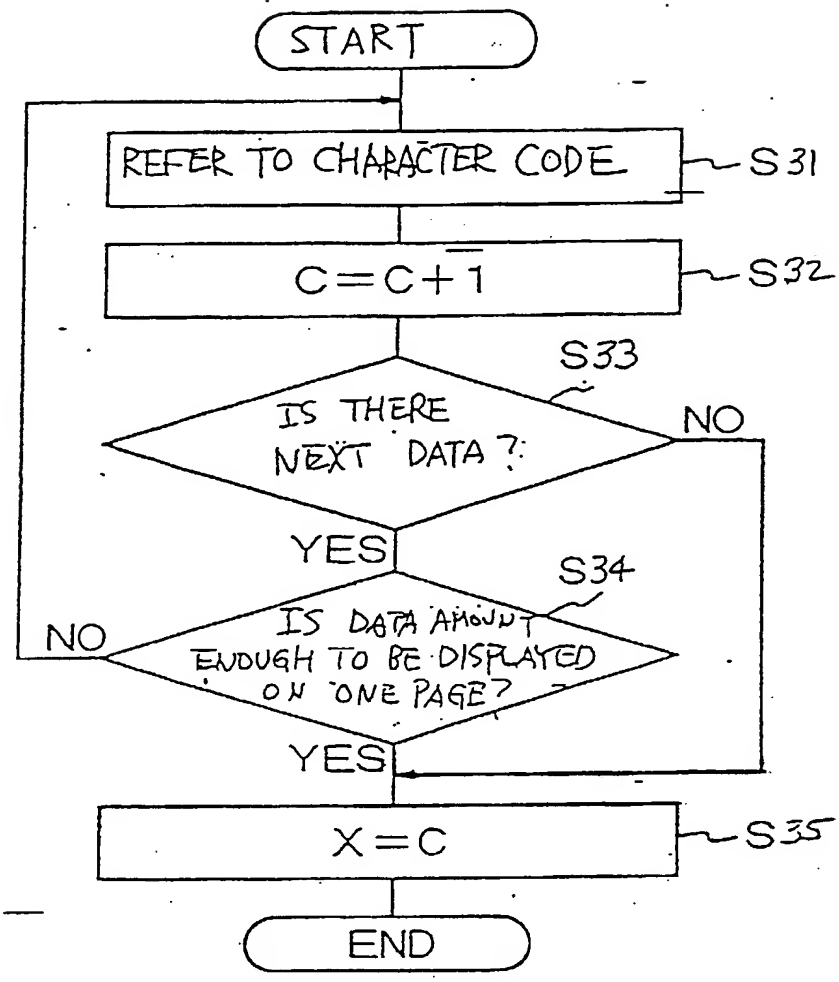


FIG. 8

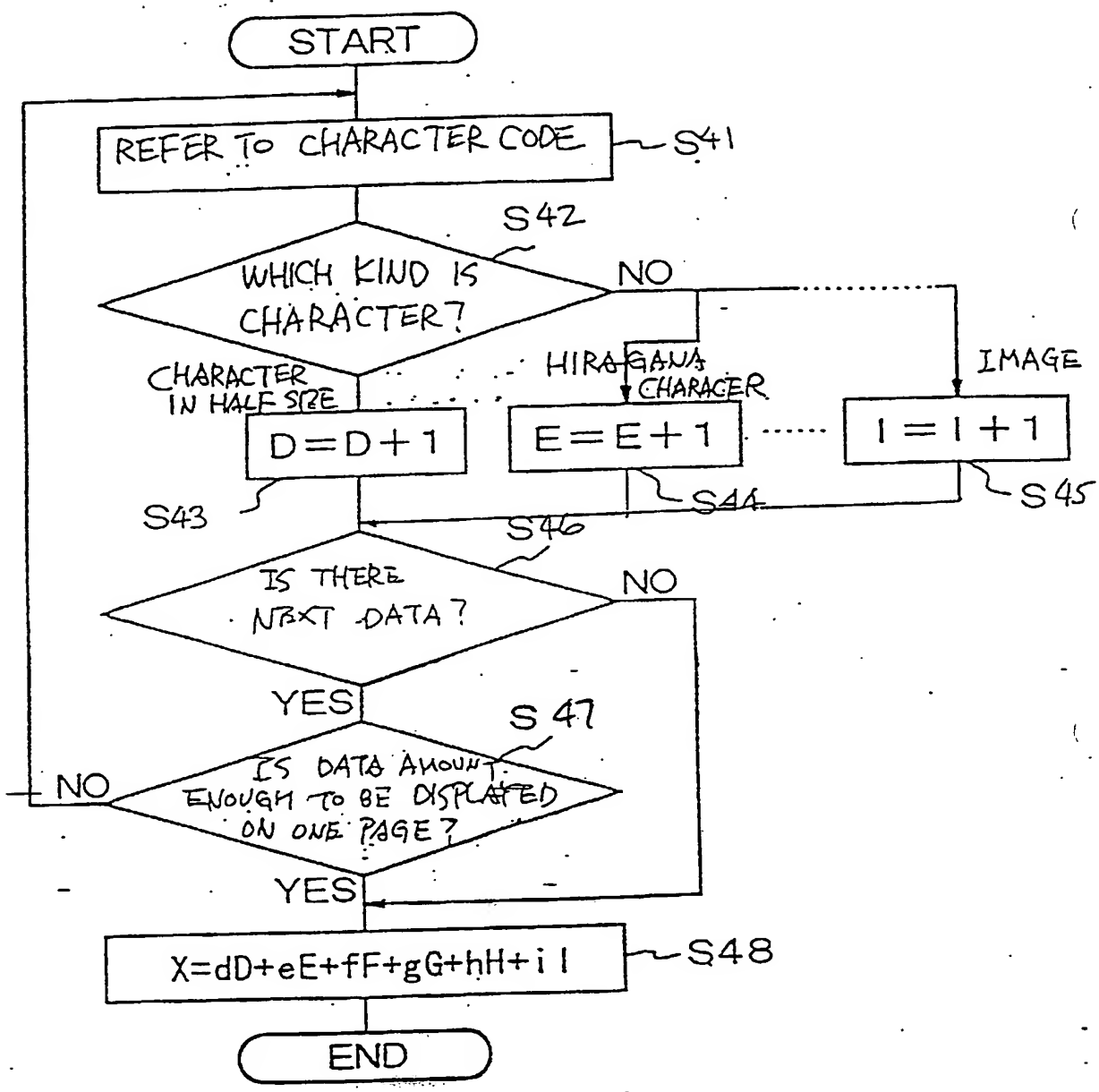


FIG. 9

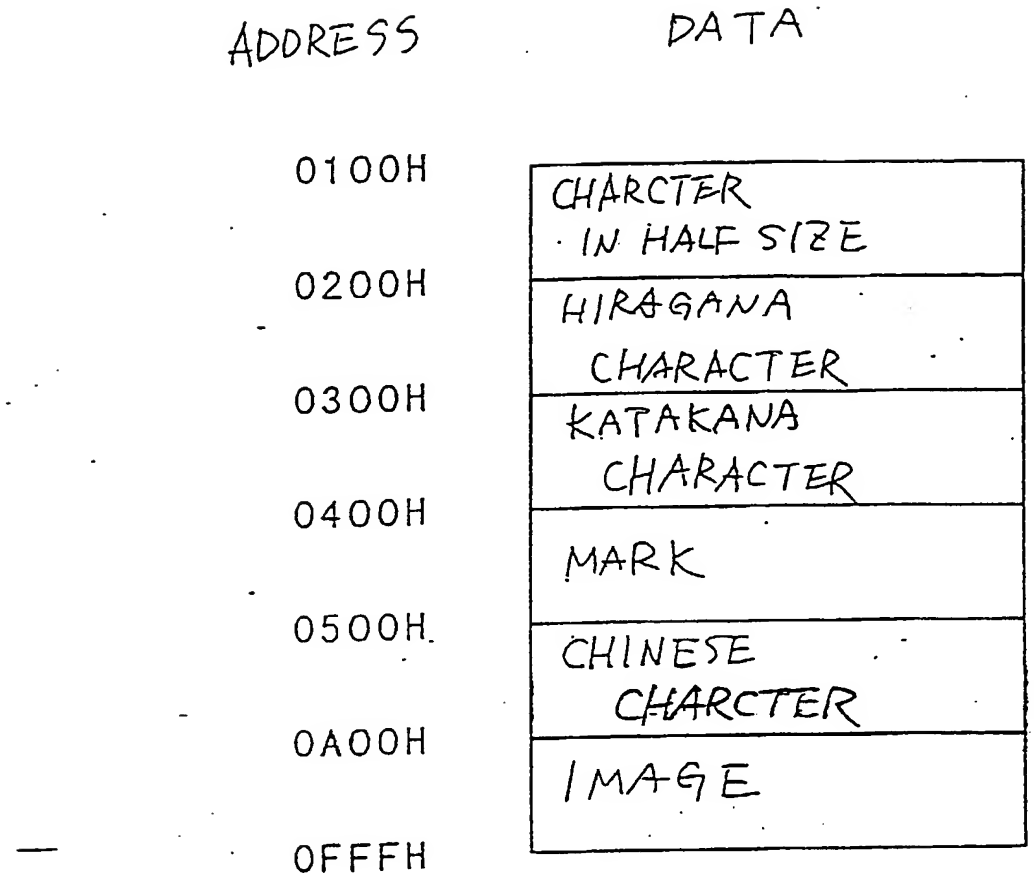
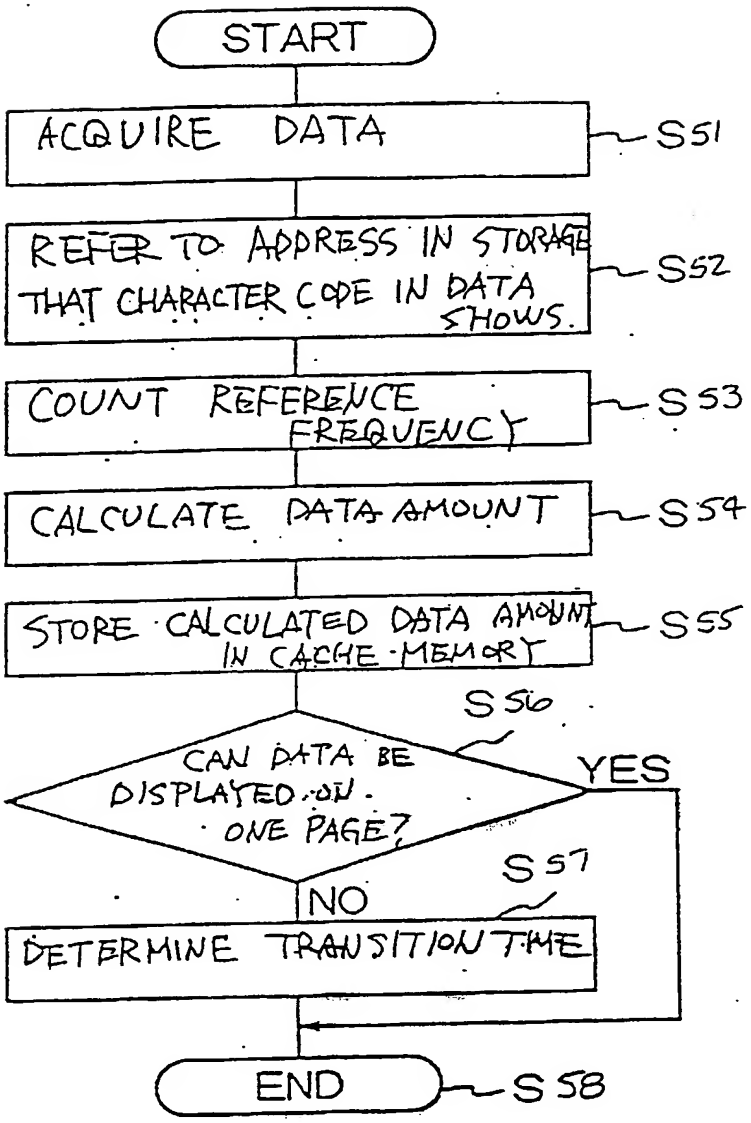


FIG. 10



PORTABLE TERMINAL HAVING A DISPLAY APPARATUS AND METHOD OF CONTROL THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a portable terminal having a display apparatus and a method of controlling the apparatus. In particular it relates to displaying information on the display apparatus and a method for control thereof, wherein the display apparatus is capable of automatically scrolling a page of data presented on the display apparatus.

2. Description of the Related Art

The amount of communication data that a portable terminal is able to transmit or receive constantly increases every year. Transmission rate enhancement enables the portable terminal to transmit or receive larger amounts of data. On the other hand, to reduce the power consumption of the portable terminal, the conventional portable terminal is usually small in size. Thus, the conventional portable terminal does not have a large display screen that would enable a large amount of data to be displayed (e.g., a liquid crystal display (LCD)). Thus, conventional portable terminals make it difficult to utilize technology for communicating large amounts of data.

Although the amount of data received by a conventional portable terminal increases, its ability to display the data on a screen of the portable terminal is not enhanced. Using an electronic mail as an example, in order to display a character string of the electronic mail that can be displayed on one page of a display screen of a personal computer, the portable

terminal requires a plurality of pages to display the same character string. In such a case, a user must depress a button repeatedly in order to turn to the next display page. More importantly, the user's repeated pressing of the button to turn display pages will eventually lead to deterioration of the button's operation.

To avoid the deterioration described above, a conventional portable terminal automatically turns a page to the next page every time when a constant period of time has elapsed. This elapsed time period causes problems that directly arise from the amount of time that a user requires to read the contents of a page displayed on the display screen. If the contents displayed on one page include many Chinese characters, the user may require a long time to finish reading the contents. On the other hand, if the contents displayed on one page include many hiragana characters and/or katakana characters, or if a line introduces a large blank space, the time required to finish reading the contents displayed on the page is shorter. Thus, when the conventional portable terminal updates the page on the display screen after a constant period of time elapses, an inconsistency arises: either the display screen is updated before the user finishes reading the page or the user wastes time waiting for the display screen to update because the user was able to read the page quickly. When such an inconsistency occurs, a user must execute an operation to return to the preceding page so as to be able to read the preceding page again. The user is then required to execute an operation to advance to the next page to be displayed. Thus,

the automatic transition of pages conversely increases the quantity of operations.

SUMMARY OF THE INVENTION

It is therefore an object of the preferred embodiments of the present invention to provide a portable terminal with a display apparatus and method of displaying data on the display apparatus wherein the transition of pages can be automated at suitable speed for a user.

Another object of the preferred embodiments of the present invention is to provide a portable terminal with a display apparatus and method of displaying data on the display apparatus wherein a large amount of communicated data can be easily handled.

A portable terminal according to an embodiment of the present invention comprises a receiver for receiving data, a display for displaying the data, wherein a first portion of the data is displayed on a first page and a second portion of data is displayed on a second page by scrolling the first page, and a controller for determining a page scrolling speed based on the content of the first portion of the data, wherein the scrolling of the first page to the second page is automatic and performed at the page scrolling speed.

A display apparatus according to an embodiment of the present invention comprises a display for displaying data including first data, and a controller for determining a content of the first data which is displayed on a page of the display, whereby the controller determines a display time for the first data.

A method of controlling a display apparatus, according to an embodiment of the present invention, comprises determining a content of first data which is displayed on a first page, and determining a first display time when the first data is displayed on the first page based on the content of the first data.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

FIG. 1 is a diagram showing an embodiment of a portable terminal having a display apparatus according to the present invention;

FIG. 2 is a flowchart showing the operations of the first embodiment of a display apparatus according to the present invention;

FIG. 3 is a flowchart showing the operations for determining a transition time of the first embodiment according to the present invention;

FIG. 4 is a flowchart showing the operations for calculating a data amount of data currently displayed on a page of a first embodiment according to the present invention;

FIG. 5 is a table illustrating how a user can set the scrolling time;

FIGS. 6A-6D are diagrams illustrating the transitioning of a display screen having Chinese characters, Hiragana (Japanese) characters and ASCII characters according to the

present invention;

FIG. 7 is a flowchart showing the operations of a second embodiment of a display apparatus according to the present invention;

FIG. 8 is a flowchart showing the operations of a third embodiment of a display apparatus according to the present invention;

FIG. 9 is a table showing correspondence between stored data and a memory address; and,

FIG. 10 is a flowchart showing the operations of a fourth embodiment of a display apparatus according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the present invention will be discussed by referring to the drawings.

In a portable terminal shown in FIG. 1, an antenna 1 is coupled to a radio communication device 2. The radio communication device 2 converts a high-frequency radio signal received by the antenna 1 by demodulating the received high-frequency radio signal and outputting a digital signal. The received high-frequency signal undergoes noise reduction prior to demodulation by the radio communication device 2. The portable terminal can be a mobile communication apparatus such as a mobile telephone and a mobile data terminal, which has a display apparatus for displaying received data and/or operational information.

The radio communication device 2 is coupled to a control device 3. The control device 3 extracts and detects

information data from the digital signal demodulated by the radio communication device 2. The control device 3 is further coupled to a storage device 4. The storage device 4 has a read only memory (ROM) 9 which stores character font data 7n. The control device 3 refers to the character font data 7n stored in the ROM 9 and reads the character font data 7n identical to a character code included in the demodulated digital signal. The control device 3 is coupled to a display 5. The control device 3 instructs the display 5 to display a character, a graphic form or other graphical forms (hereinafter simply called the "character string") corresponding to the character font data 7n which is identical to the character code included in the demodulated digital signal.

The control device 3 is provided with a counter 6 for counting the reference frequency N of the character font data 7n stored in the ROM 9. The control device is further provided with a calculator 8 for calculating the data amount Q of data currently displayed on the display 5 according to the counted reference frequency N. The storage device 4 is provided with a random access memory (RAM) (not shown) for storing received data as well as the ROM 9 for storing the character font data 7n.

The display 5 is provided with a LCD screen (not shown) for displaying the character string and a LCD driver (not shown) for operating the LCD screen. An operator console 11 is connected to the control device 3. The operator console 11 is provided with a navigation button 12 for turning a page presented on the LCD screen to the preceding page or the next

page. Navigation button 12 allows the user to execute page scrolling if the character string to be displayed on the display 5 ranges over plural pages of the LCD screen. A power source 13 supplies power to each of the above devices.

The antenna 1 receives a high-frequency data signal that the radio communications device 2 demodulates and converts into a digital signal. Information data to be displayed on the display 5 is included in the digital signal and is converted to a character string by referring to the character font data 7n stored in the ROM 9. The character string is displayed on the display 5.

A method of scrolling a page presented on the LCD screen includes a manual page scrolling method and an automatic page scrolling method. A first embodiment for scrolling of pages presented on a portable terminal according to the present invention is shown in FIG. 2. The first embodiment can execute both of the automatic page scrolling method and the manual page scrolling method. At Step S1, the control device 3 instructs the display 5 to display a leading page of the character string. At Step S2, a determination is made if there is a next page to display. If there is no more data to be displayed subsequent to data currently displayed on the leading page (i.e., there is no next page), then, at Step S7, the display of the leading page currently displayed continues.

If there is data to be displayed on the next page, then, at Step S3, the data can be displayed on the display 5 by depressing the navigation button 12 of the operator console 11. The navigation button 12 can select either a succeeding page or

a preceding page as the next displayed page.

At Step S4, a transition time X elapses because the navigation button 12 was not pressed. At Step S5, a determination is made whether an automatic page-scrolling mode in which the next page is automatically displayed after the transition time X elapses is set. The setting of automatic scrolling mode will be discussed later. If the automatic page-scrolling mode is not set, at Step S6, the control device 3 automatically instructs the display 5 to display the next page. That is, the next page is displayed after the previous page was displayed for the transition time X. A timer (now shown) in the control device 3 counts the transition time X.

FIG. 3 depicts a method for determining the transition time X, wherein a page of the LCD screen is automatically turned from a current page to the next page. At Step S11, the control device 3 acquires the information data including character codes from the radio communication device 2. The acquired information data includes addresses that correspond to the individual character codes.

In Step S12, the control device 3 reads the corresponding character font data 7n by referring to the address corresponding to the acquired character code. The control device 3 decodes the character font data 7n and instructs the display 5 to display the decoded character font data 7n. At Step S13, when the character font data 7n is displayed as a character string, the control device 3 counts the reference frequency N of the address of the ROM 9. At Step S14, the data amount Q of the character string displayed on one

page is calculated based upon the reference frequency N for displaying the character string on the one page. At Step S15, a determination is made whether the calculated data amount Q is capable of being displayed on a single screen. If the calculated data amount Q is less than a maximum data amount of data capable of being displayed on one page, then, at Step S17, the control device 3 terminates the page scrolling processing, and the display 5 continues to display the current displayed page, and this process terminates without determining the transition time.

If a character string to be displayed on the next page exists, then, at Step S16, the control device 3 calculates the transition time X based upon the calculated data amount Q of data displayed on the one page. At Step S17, the control device 3 terminates the transition time determination process with respect to the page scrolling from the current page to the next page.

FIG. 4 depicts a method of calculating the data amount Q of data currently displayed on one page is shown. At Step S21, the control device 3 counts the reference frequency N to an address of the ROM 9. At Step S22, the control device 3 determines whether the character to be displayed, indicative of a character code, is a 2-byte character or a 1-byte character. At Steps S23-S24, if the number of 2-byte characters is A (its initial value is zero) and the number of 1-byte characters is B (its initial value is zero), each reference frequency is incremented every time one character is counted as shown in Equation 1.

$$A = A + 1,\ B = B + 1 \quad \text{(Equation 1)}$$

At Step S25, a determination is made whether more data exists. If no more data exists, calculation of Equation 1 ceases. If more data does exist, then, at Step S26, a determination is made concerning whether the data amount Q has reached a data amount for one page. If not, data processing continues. If the data amount Q has reached a data amount for one page, then, at Step S27, the calculator 8 of the control device 3 calculates the data amount Q for the current displayed one page using values A and B according to Equation 2:

$$Q = 2A + B \quad \text{(Equation 2)}$$

Transition time X (in seconds) to the next page from the current page is calculated based upon the calculated data amount Q according to Equation 3.

$$X = T \times Q \quad \text{(Equation 3)}$$

T indicates unit scrolling time (in seconds). The unit scrolling time T is a value that is variably set by a user as shown in FIG. 5 and is stored in the storage device 4 beforehand.

A user depresses a function key (provided on the operator console 11, though not shown) for setting an automatic scrolling mode. The user can select one of three types of scrolling speeds: "fast", "normal" and "slow". The scrolling speeds of the "fast", "normal" and "slow" respectively correspond to a unit scrolling times T1, T2 and T3, as shown in FIG. 5. The unit scrolling times T1, T2 and T3 are registered in the storage device 4 as a variably set timing factor. For example, the unit scrolling times T1, T2 and T3 may be set to

1, 2 and 3 seconds, respectively. An automatic scrolling mode may be also set by operating the operator console 11 without independently providing the function key for setting an automatic scrolling mode.

FIGS. 6A-6D illustrate an example of the transitioning of the LCD screen of the display 5 according to the present invention. The display screens shown in FIGS. 6A-6D are displayed in sequential order. The display screens illustrated in FIGS. 6A-6D present Chinese characters, Hiragana (Japanese) characters and ASCII characters to the user. It should be understood that the invention is not limited to any particular character set, and the character sets used in FIGS. 6A-6D are for illustration purposes only.

For example, when the unit scrolling time T is set to 1 second, the transition time X of each page is as follows:

Referring to FIG. 6A, this is the leading page displayed on the LCD screen of the display 5. This leading page displays 33 two-byte characters and 4 1-byte characters. The transition time is calculated as follows:

A = 33, B = 4, X = 70 (seconds)

Referring to FIG. 6B, this is the second page displayed on the LCD screen of the display 5. This second page displays 22 two-byte characters. The transition time is calculated as follows:

A = 22, B = 0, X = 44 (seconds)

Referring to FIG. 6C, this is the third page displayed on the LCD screen of the display 5. This third page displays 16 two-byte characters. The transition time is calculated as

follows:

A = 16, B = 0, X = 32 (seconds)

Referring to FIG. 6D, this if the final page displayed on the LCD screen of the display 5. This final page displays 14 two-byte characters. The transition time is calculated as follows:

A = 14, B = 0, X = 28 (seconds)

In each page shown in FIGS. 6A-6D, Chinese characters and Hiragana (Japanese) characters are counted as a two-byte character, and numeral characters and the remaining characters are counted as a one-byte character.

Since the leading page has characters occupying the full screen, the user will take a long time to recognize them. On the other hand, since the third page has a few characters to be displayed, the user will not require a long time to recognize them. In the example, the calculated transition time of 32 seconds for the transition from the third page to the final page is smaller than the calculated transition time of 70 seconds for the transition from the leading page to the second page. As described above, the transition time of a page having a minor amount of displayed data is shorter than that of a page having a large amount of displayed data. That is, the transition time automatically changes according to the currently displayed data amount. A user's individual preferences are met by setting the appropriate unit scrolling time T.

FIG. 7 illustrates a second embodiment of an automatic page scrolling method according to the present invention. In

this second embodiment, the method does not determine whether a character is composed of one byte or two bytes during the calculation of the displayed data amount. In Step S31, the control device 3 simply counts the reference frequency of an address of the ROM 9 in storage device 4 and sets the counted reference frequency as value C. At Step S32, for each character, the value C is incremented. At Step S33, a determination is made whether more data exists. If no more data exists, the incrementing of value C ceases. If more data does exist, then, at Step S34, a determination is made concerning whether the data amount Q has reached a data amount for one page. If not, data processing continues. If the data amount Q has reached a data amount for one page, then, at Step S35, the calculator 8 of the control device 3 calculates the transition time X for the current displayed one page using value C according to Equation 4:

$$X = C \times T \qquad \text{(Equation 4)}$$

The method of the second embodiment is effective where displayed characters are fixed as either full-sized characters (two-byte characters) or half-size characters (one-byte characters).

FIG. 8 illustrates a third embodiment of an automatic page scrolling method according to the present invention. In this embodiment, a counted reference frequency is weighted according to the type of displayed character when a data amount of displayed data is calculated. Weighting is executed to discriminate the time required for a user to recognize displayed data according to the type of the displayed character string. The types of the characters include a half-size

character such as an alphabet and numeral, a hiragana character, a katakana character, a mark, a Chinese character and an image. These kinds of characters are discriminated according to a corresponding address 0100H to 0FFFH in the ROM 9, as shown in FIG. 9.

In Step S41, the control device 3 simply counts the reference frequency of an address of the ROM 9 in storage device 4 and sets the counted reference frequency as the character type. In Step S42, the control device 3 determines the kind of a character based upon an address in accordance with the character code in the ROM 9. In Step S43, if the character type is a half-size character, then the half-size characters index increments. In Step S44, if the character is a hiragana character, then the hiragana characters index increments. In Step S45, if the character is an image, then the images index increments. In this embodiment, if the respective reference frequencies of a half-size character, a hiragana character, a katakana character, a mark, a Chinese character and an image are represented by D, E, F, G, H and I, the constants for properly weighting them are respectively entitled *d*, *e*, *f*, *g*, *h* and *i*. Steps S46 and S47 repeat the process described earlier of determining if data remains to be processed and determining if the data amount is greater that the display space. At Step S48, the transition time X is calculated by Equation 5:

$$X = (dD + eE + fF + gG + hH + iI) \times T \qquad \text{(Equation 5)}$$

The weighting constants *d* through *i* can be set to a large value in case a user requires a long time to recognize

displayed data, or can be set to a small value in case it does not take a user a long time to recognize displayed data. It is desirable that the weighting constants *d* to *i* are registered in the storage device 4 and the values are variably set by a user. Such subdivision extends processing time. However, more precise page feed, synchronized with time required for a user to recognize, is the final result.

FIG. 10 illustrates a fourth embodiment showing the automatic page scrolling method according to the present invention. At Step S51, the control device 3 acquires the information data including character codes from the radio communication device 2. The acquired information data includes addresses that correspond to the individual character codes.

In Step S52, the control device 3 reads the corresponding character font data 7n by referring to the address corresponding to the acquired character code. The control device 3 decodes the character font data 7n and instructs the display 5 to display the decoded character font data 7n. At Step S53, when the character font data 7n is displayed as a character string, the control device 3 counts the reference frequency N of the address of the ROM 9. At Step S54, the data amount Q of the character string displayed on one page is calculated based upon the reference frequency N for displaying the character string on the one page. At Step 55, the data amount of data displayed on one page is stored in a cache memory (not shown) of a control device 3. Memory capacity must be increased but the calculation of the data amount when a page once displayed and displayed again is

omitted and total processing time can be reduced. If memory capacity is limited, it is desirable that the restriction of only the preceding page and the next page is imposed as the quantity of stored total data.

At Step S56, a determination is made whether the calculated data amount Q is capable of being displayed on a single screen. If the calculated data amount Q is less than the maximum data amount capable of being displayed on one page, then, at Step S58, the control device 3 terminates the page scrolling processing and the display 5 continues to display the current displayed page, and this process terminates without determining the transition time.

If a character string to be displayed on the next page exists, then, at Step S57, the control device 3 calculates the transition time X based upon the calculated data amount Q of data displayed on the one page. At Step S58, the control device 3 terminates the transition time determination process with respect to the page scrolling from the current page to the next page.

According to the present invention, transition of pages of a display screen at suitable speed can be automated based on a data amount of each page. The amount of communicated data can be greatly increased by such automatic transition.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present invention embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended

claims rather than by the foregoing description, and all changes which come within the means and range of equivalency of the claims are therefore intended to be embraced therein.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

Character font data is stored in a ROM at specific addresses. When display data included in a demodulated digital signal is displayed on a leading page using the character font data, a controller counts the frequency of reference to the memory. The controller calculates an amount of the display data based on the reference frequency and determines a transition time to a second page from the leading page based on the amount of the display data and the type of data displayed.

CLAIMS:

1. A portable terminal, comprising:

a receiver for receiving data;

a display for displaying the received data, wherein a first portion of the received data is displayed on a first page and a second portion of received data is displayed on a second page by scrolling the first page; and,

a controller for determining a page scrolling speed based on the content of the first portion of the received data, and for scrolling the first page to the second page at the page scrolling speed.

2. The portable terminal as claimed in claim 1, wherein said controller comprises:

a first calculator for calculating an amount of data of the first portion of the received data; and,

a second calculator for calculating the page scrolling speed based on the amount of the first portion of received data.

3. The portable terminal as claimed in claim 2, further comprising:

a storage device for storing font data associated with an address;

wherein the first calculator determines a frequency of reference to the storage device to display the first portion of the received data on the first page, and wherein calculating the amount of the first portion of the data is

based on the frequency of reference.

4. The portable terminal as claimed in claim 2, wherein the first calculator comprises a determination unit for determining a character type included in the first portion of the data, wherein the data amount calculation is based on the character type.

5. The portable terminal as claimed in claim 4, wherein the first calculator applies a weight to the amount of data based on the character type.

6. The portable terminal as claimed in claim 4, wherein the type of character includes at least one of an alphabetic character, a numeral, a Chinese character, a Hiragana character, a Katakana character and an image.

7. The portable terminal as claimed in claim 1, further comprising an operation unit for a user to set a page scrolling mode, whereby the controller scrolls the first page only when the page scrolling mode is set.

8. The portable terminal as claimed in claim 1, further comprising a speed adjuster for adjusting the page scrolling speed based on an operation by a user.

9. A portable terminal substantially as herein described with reference to and as shown in the accompanying drawings.

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20

Application No: GB 0115394.9
Claims searched: All
Examiner: Joe McCann
Date of search: 3 December 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): H4T(TBAX)

Int Cl (Ed.7):

Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	JP 07-140963 (KOKUSAI ELECTRIC) - see abstract	1,2

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.